Scientific Works. Series C. Veterinary Medicine. Vol. LIX (3)
ISSN 2065-1295, ISSN Online 2067-3663, ISSN-L 2065-1295

CONTRIBUTIONS TO THE TREATMENT OF TRAUMATIC ORTHOPEDIC DISORDERS IN BIRDS

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Abstract

The aim of this study was to determine the rate of healing of bone tissue correlated with the type of treatment applied at 34 birds, both domestic and wild, presented in the Surgery Clinic between 2005 and 2013, suspected of traumatic orthopedic conditions. In order to remedy these orthopedic disorders it was used either singular fixation methods (bandage / splint, intramedulary nail, external fixator, cerclage) or mixed systems (intramedulary nail + splint / bandage; intramedulary nail + cerclage, external fixator + intramedulary nail). In most cases, we combined methods to counteract the destabilizing forces acting on the fracture. Recent tibiotars, radius and ulna fractures which allowed the application of the biological fixation, involving a closed reduction of bone fragments and a minimally invasive surgical approach, have led to bone healing in a greater proportion. Death of convalescent wild birds was the most common cause for fracture healing failure.

INTRODUCTION

Currently, there are few studies regarding the healing of fractures of the bird species. Most data show similarities between bone growth and fracture healing between birds and mammals, but also some differences.

Whether using internal fixation methods or external fixation, it is essential toproperly understand growth and bone healing in birds (Tully, 2002).

While, in the pets, there are available a number of techniques, the selection of the fixation method in birds should consider a method to be followed by a healing bone and thus functional recovery as soon as possible.

Prevention of the release of catecholamines by administration of analgesics and sedatives in species of small birds of prey may save their lives. However, despite great success and survival rates observed over the last decade with the use of analgesics and progress in surgical techniques, fracture repair failure resulting birds are still in a significant number (Helmer and Lightfoot, 2002).

The aim of this study was to determine the rate of healing of bone tissue correlated with the type of treatment applied to the cases studied. It was intended to apply both the biological fixation, which entails a reduction of bone fragments and a closed minimally invasive surgical approach and the conventional techniques that involves large incisions of the soft tissue and bone fragments fixation after internal reduction and handling.

MATERIALS AND METHODS

The research was conducted in the Laboratory of Diagnostic Imaging and Surgery Clinic of the Faculty of Veterinary Medicine from Timisoara, taking into study 34 birds, both domestic and wild, presented in the Surgery

Clinic between 2005 and 2013, suspected of traumatic orthopedic conditions.

Of the 34 subjects in the study, the highest proportion was occupied by the domestic pigeon (21 subjects), followed by the hawk (5 subjects) and the common kestrel (3 subjects).

Radiographic evaluation was carried out by conventional radiography using this Siremobil Compact L (Siemens) device and radiological facility type Multix Swing (Siemens). Image processing was done via the computerized radiography (CR) CR Vista Direct View (Carestеam) and AQS Vet Standalone software (Arzt + Praxis GmbH).

In order to remedy these orthopedic disorders it was used either singular fixation methods (bandage / splint, intramedulary nail, external fixator, cerclage) or mixed systems (intramedulary nail + splint / bandage; intramedulary nail + cerclage, external fixator + intramedulary nail). In most cases, we combined methods to counteract the destabilizing forces acting on the fracture.

Surgical interventions were performed on animals under general anesthesia or dissociative anesthesia using xylazine 2% (Narcoxyl-MSD Animal Health) and ketamine 10% (Ketaminol-Intervet) or stable anesthesia with propofol injection 1% (Lipuro) or ketofol (ketamine-propofol combination administered intraosseous).

Fixation techniques used:

1. Internal fixation using intramedulary nailing

As a mean of internal fixation it was used intramedulary implantation of rods (hypodermic needles), considering a normograde insertion technique but also a retrograde technique described by various authors (Doneley, 2010; Igna et al., 2011).

For humeral fractures it was used only the retrograde implantation technique of intramedullary nails, after a ventral approach of the fracture.

For tibiotars fracture we inserted the metalic implant both retrograde and normograde (Fig. 1) after the fracture was approched on the medial side. Rod insertion was done both cranio-proximal (to the notch) and disto-caudal (the condyle) (Fig. 1).

Fig. 1. Tibiotars old fracture set by open reduction of the fragments (retrograde technique with distal insertion: disto-caudal of condyles) (pacient no. 14)

In some cases the implant was inserted after an open reduction - intraoperative reduction of fragments (Fig. 1).

In tibiotars recent fractures we achieved a closed reduction of the bone fragments and rod insertion under fluoroscopic control allowing assessment of progression and stability of the implant and the adequat reduction (biological osteosynthesis) (Fig. 2).

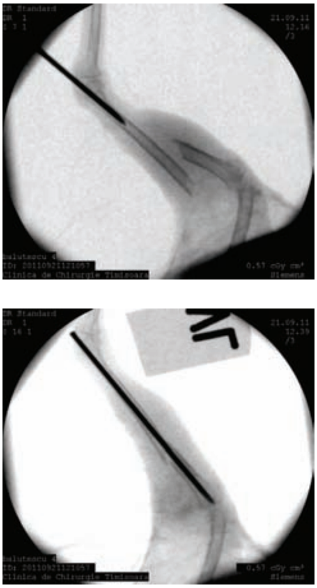


Fig. 2. Normograde insertion of intramedullary nail under fluoroscopy - proximal diaphyseal fracture tibiotars, easy in the pigeon

In recent fractures of the radius and ulna we also used indirect/closed reduction of bone fragments and insertion of nail under fluoroscopy and through out soft tissue small incisions (biological fixation) via normograde and retrograde technique. Rod insertion was performed starting distal radius and the olecranon for the ulna.

2. Internal fixation using cerclage.

In one case, a diaphyseal fracture of the humerus with a long oblique paths, the stable fixation was achieved by interfragmentary compression offered only by placing a wire circumferentially around the bone - the application of cerclage - after the technique described by Igna et al., 2011.

3. Internal fixation using nail-cerclage system.

We relied on this type of stabilization for fractures of the humerus (Fig. 3) and metacarpal fracture with long oblique paths or comminuted fractures.

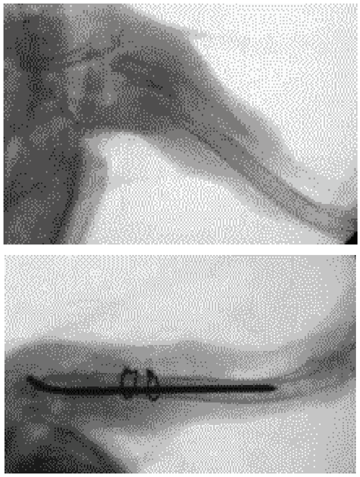


Fig. 3. Mixed system: intramedullary nail – cerclage for the treatment of a proximal diaphysis comminutive humeral fracture – Goshawk.

4. Combined fixation using rod-splint system.

We used this type of stabilization in tibiotarsal and tarsometatarsal fractures (Fig. 4) and for those of humeral fracture with a short oblique or transverse path in ordet to annihilate rotation forces not only neutralized by nail insertion. Insertion of nail was performed either by open or closed reduction (Fig. 4).

5. ***External fixation using either single external fixators (fig. 5), either external fixator – intramedullary nail system***

We used this type of stabilization for radio-ulnar fractures and correction of limb positining in malunion cases (Fig. 5) or angular growth deformity of the tibiotars. The latter, initially assumed an osteotomy to correct limb position.

We used linear external fixators (FEL) type II (bilateral monoplanar system), which connect unthreaded transfixic inserted through the bone rods by means of chemical substances, plastic and adhesive (acrylate-or polymer-Poxilină Duracryl) thus obtaining a "acrylic assembly" according to the technique described by Igna et al., 2011.

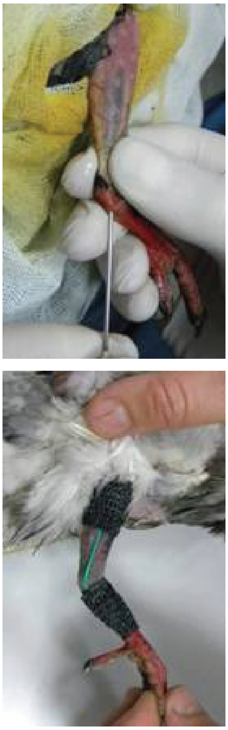


Fig. 4. Combined fixation (intramedullary nail-splint) of a tranverse diaphyseal fracture of the tibiotars (distal insertion: disto-caudal from condyles of the tibiotars) (Pacient no. 13)

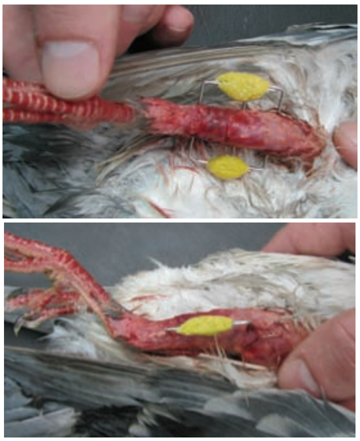


Fig. 5. Tibiotars maluniune in a pigeon treated by FEL type II in an acrylic device

To prevent postoperative infection it has been used the administration of amoxicillin-clavulanic acid (Synulox) orally at a dose of 125 mg / kg every 12 hours or intramuscularly at a dose of 60-120 mg / kg every 12 hours for 7 days postoperatively. In cases of open fractures antibiotics was performed for a period of 14 days.

RESULTS AND DISSCUSIONS

Of all injuries, bone healing occurred in 51.43% of cases (22.86% in less than 4 weeks, 25.71% in less than 6 weeks and 2.86% for less than 8 weeks) and complications such as nonuniune (osteomyelitis, arthritis) (fig. 6) and failure to stabilize (Fig. 7, 8) have been recorded in equal proportions by 8.57%.

Soft tissue healing associated with bone lesion occurred without complications at a rate high enough, signaling necrosis is only 2.86% of cases.

In this study it has been managed a fairly high number of cases by closed reduction of the fracture, which involved handling by traction and countertraction of the fragments for alignment. Proper alignment and reduction of fragments may be difficult to achieve by indirect reduction and may result in significant soft tissue injuries especially for small birds. In the present study, closed reduction represented a less invasive technique that allowed alignment and axial rotation of the fragments without compromising soft tissue and subsequent bone healing.

Similar observations have been reported by other authors (Olsen et al., 2000; Orosz, 2002; Redig et al., 2001).

The time required for fracture healing in birds decreases proportional to the stability of the fracture.

The time for radiographic fracture healing of most cases (48.57% <6 weeks) corresponds to the interval of 3-6 weeks reported by many authors (Bush et al. 1976; Newton and Zeitlin, 1977; Pollock, 2002).

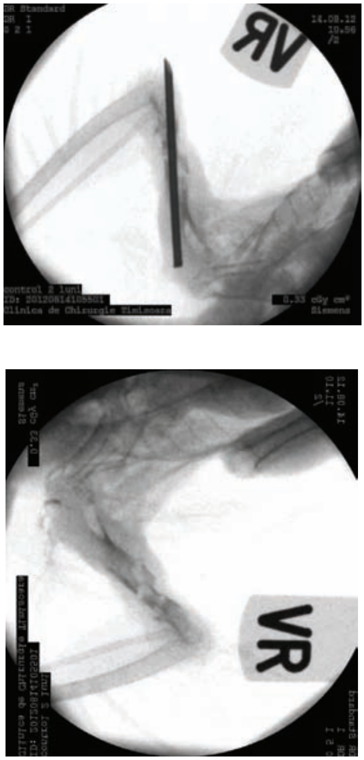
Also, others authors (Olsen et al. 2000; Orosz, 2002; Redig, 2001; Redig et al., 2001) reported that in most cases with uncomplicated fractures, bone union is completed 6 weeks after fixation.

Redig, 1999 cited by Pollock, 2002 reported that the intervals in which fracture healing is obtained depends on its location. Thus, if fractures of the humerus have been reinforced within 3 weeks and fractures of the radius and ulna in 4 weeks, femur fractures healing was accomplished in 4-6 weeks after immobilization. Exception made metacarpal and metatarsal fractures; because of the reduced blood flow healing was complete in 4-6 weeks (slowly).

Death of patients occurred in 28.57% of cases (10 subjects). Exitus occurred at a greater rate of 80% (8 subjects) in wild birds (eagle, hawk, owl) and to a lesser extent in the pigeon (20% - 2 subjects). In 70% of cases (7 subjects) paciets have had at least one open fracture and in 80% of cases the lesion involved the superior limb, humerus in default.

Stress during hospitalization demonstrated by some species of birds make orthopedic procedure to result in failure due to complications arising during the period of convalescence, even if the initial fracture stabilization was successful.

Farrow, 2009 also specifies that fractures (single or multiple) healed in wild birds are clearly an exception, as most birds suffer broken bones or wings and do not survive long enough to heal, except if they receive proper food adequat for the needs of the species and a protected environment in which to recover. Account must be taken of the fact that the wing is weaker than any other part of the structure of wild birds and the lesions located on the wing, either directly or indirectly, are found to be often fatal.



a.

b.

Fig. 6. Nonuniune of the humerus secondary to osteomyelitis–Common kestrel (pacient no. 2) at 8 weeks postoperatively (lack of callus, cortical lysis)

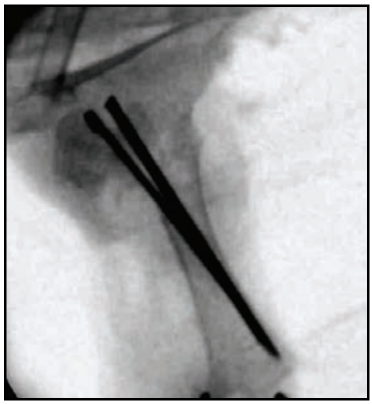


Fig. 7. Failure to stabilize a fracture of the humerus located on the proximal diaphysis – metaphysis

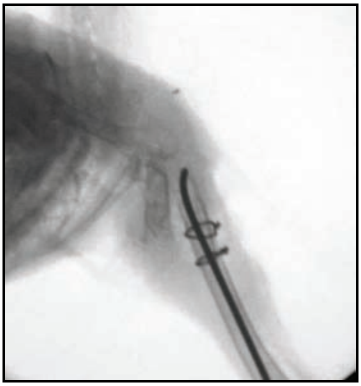


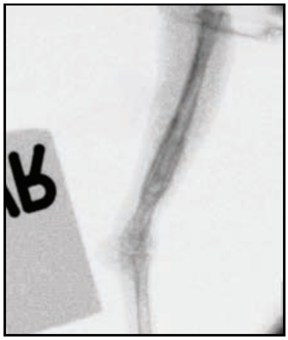
Fig. 8. Destabilization of the implant and fixation failure - humeral fracture, comminuted, metaphysis - proximal diaphyseal

In the case of humerus fracture healing occurred only along with the use of intramedullary pins and cerclage associated with intramedullary pins but in low proportions of 25% and 8% (of all fractures of the humerus) (fig. 9). Failure to heal in cases of other methods can not be attributed only on the technique and should be kept in mind that a significant percentage of patients with lesions in the humerus died during convalescence.

Fig. 9. Consolidated humeral fracture, control 1 month after surgery – Goshawk (Pacient no. 12)

Lesions localized to the tibiotars ended with healing in the largest proportion (40% of all fractures tibiotars) when using a mixed assembly (intramedullary nail – splint) (Fig. 10).

a.



b.

Fig. 10. Enhanced fracture of the tibiotars, 1 month postoperatively (pacient no. 13) - Pigeon

In the case of radial fractures, intramedullary nails was followed by bone healing is the highest proportion (40% of all fractures of the radius) (Fig. 11).

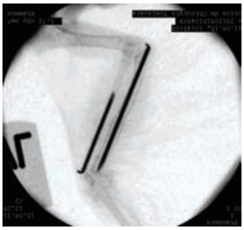
The usege of bandages and pins inserted intramedullary allowed ulna fracture healing in similar proportions of 29% (of total ulna fractures).

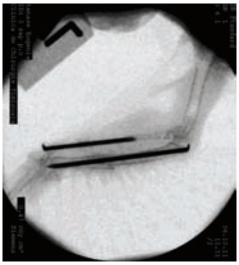
Newton and Zietlin 1977 reported bone healing in radio-ulnar fractures (both bones broken) with radiographic confirmation of bone union by mineralized callus at 5 weeks po after internal fixation and 8 weeks after external fixation.

The use of external fixation (bandage) to cases in which only the radius was fractured and ulna was intact resulted in a highlighting endosteal sponge callus in 3 weeks after immobilization (Newton and Zeitlin, 1977).

Newton and Zietlin, 1977 reported that pigeons with radio-ulnar fractures in the and internal fixation of both bones, achieved complete union of the fragments and the onset of callus remodeling at 4 weeks postoperatively.

Also, in the study of Farrow, 2009, simple radius fractures without displacement, localized in the middle third of the shaft healed within 3-4 weeks if the ulna was intact. If, however, ulna is fractured, but the fragments do not show a high degree of displacement, healing period was extended by 1-2 weeks.


a.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c.

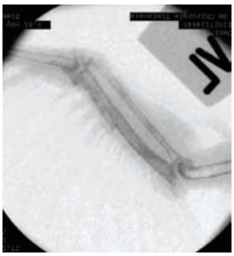
d.

Fig. 11. Enhanced radio-ulnar fracture. a. postoperatively;b. 3 weeks postoperatively, c-d. 6 weeks (subject no. 21)

Of the three patients with metacarpal fracture, healing was achieved in two cases and in one reported failure to stabilize mainly due to compromised blood flow in fractured area resulted in both soft tissue and bone necrosis (fig. 12).

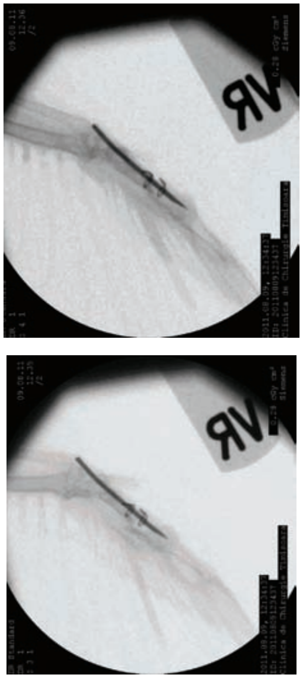

Fig. 12. Nonuniune / necrosis of bone- 6 weeks postoperatively (pacient no. 18)

The carpo-metacarpal region, because soft tissues are poorly represented, the blood supply is reduced which adversely affect the healing of bone tissue.

Moreover, carpo-metacarpal fractures are considered by some authors (Orosz, 2002; Redig et al., 2001) releasing high energy fractures produced by power lines or gunshot, described as being open and comminuted which substantially reduces the rate of successful treatment when compared to other long bones.

CONCLUSIONS

Recent tibiotars, radius and ulna fractures which allowed the application of the biological fixation, involving a closed reduction of bone fragments and a minimally invasive surgical approach, have led to bone healing in a greater proportion.

Tibiotars injuries resulted in the highest proportion of healing (40%) when using a mixed assembly intramullary nail-splint.

Radial fractures healed in the highest proportion (40%) by using intramedullary pins.In birds, in order to obtain an optimal fracture healing, it should be properly reduced, stabile and, especially, to ensure an adequate blood supply at the fracture site.

Death of convalescent wild birds was the most common cause for fracture healing failure.

Stress during hospitalization of wild bird makes the orthopedic procedure to result in failure due to complications arising during the period of convalescence, even if the initial fracture stabilization was successful.

REFERENCES

Bush, M., Montali, R.J., Novak, G.R., 1976. The healing of avian fractures: A histological xeroradiographic study, J Am Anim Hosp Assoc., 12, 768–773.

Doneley, B., 2010 Avian Medicine and Surgery in Practice Companion and aviary birds, Ed. Manson Publishing/The Veterinary Press, London.

Farrow, C.S., 2009.Veterinary diagnostic imaging: birds, exotic pets, and wildlife, Ed. Mosby Elsesier, St. Louis, Missouri.

Helmer, P.J., Lightfoot, T.L., 2002. Small exotic mammal orthopedics, Veterinary Clinics of North America: Exotic Animal Practice, 5, 1, 169 – 182.

Igna, C., 2011. Chirurgia ortopedică a animalelor de companie, vol. I, Ed. Brumar, Timişoara.

Newton, C.D., Zeitlin, S., 1977. Avian fracture healing, J Am Vet Med Assoc., 170, 620–625.

Olsen, G.H., Redig, P.T., Orosz, S.E., 2000. Limb dysfunction. In: Manual of Avian Medicine, Edit. OLSEN, G.H., OROSZ SE, Ed. Mosby, St. Louis, p. 493–526.

Orosz, S.E., 2002. Clinical considerations of the thoracic limb, Veterinary Clinics of North America: Exotic Animal Practice, 5, 1, 31 – 48.

Pollock Christal, 2002. Postoperative management of the exotic animal patient, Veterinary Clinics of North America: Exotic Animal Practice, 5, 1, 183 – 212.

Redig, P.T. 2001. Anatomical and surgical considerations of the avian thoracic limb, Proceedings of the 21st Annual Conference and Expo, Portland, 429–438.

Redig, P.T., Suzuki, Y., Abu, J., 2001. Management of orthopedic problems of the avian forelimb, Proceedings of the 22nd Annual Conference and Expo of Association of avian veterinarian, 22-24 august, Orlando, Florida, 307 – 322.

Tully, Thomas N., 2002. Basic avian bone growth and healing, Veterinary Clinics of North America: exotic animal practice, 5, 1, 23 – 30.